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# Gas Journal

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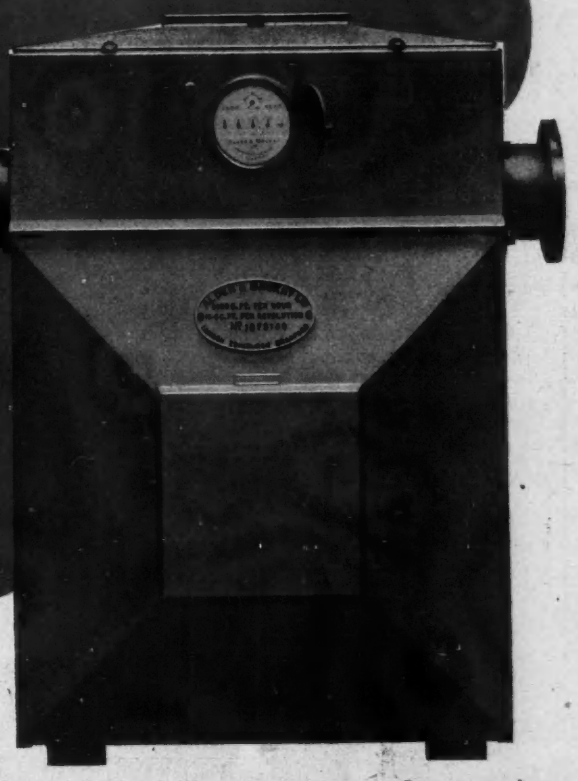
## Meters for the Industrial Load



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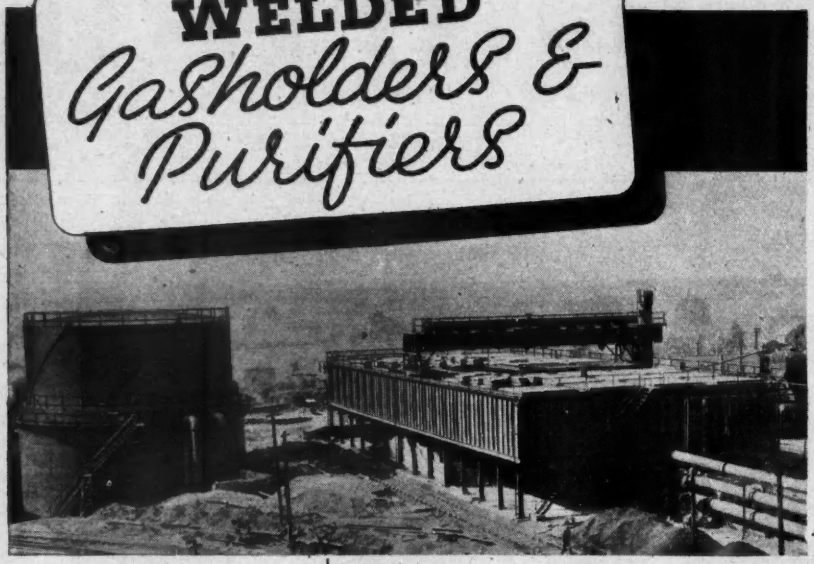

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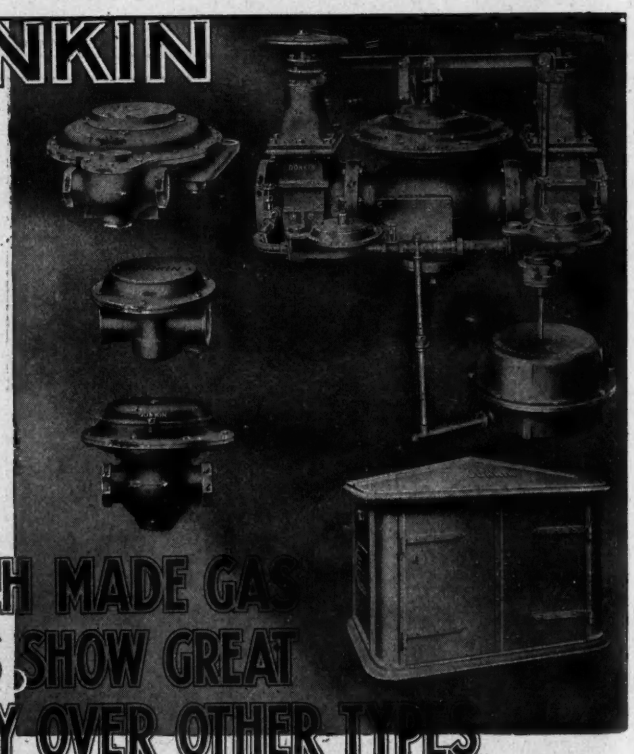

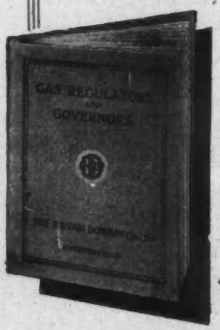


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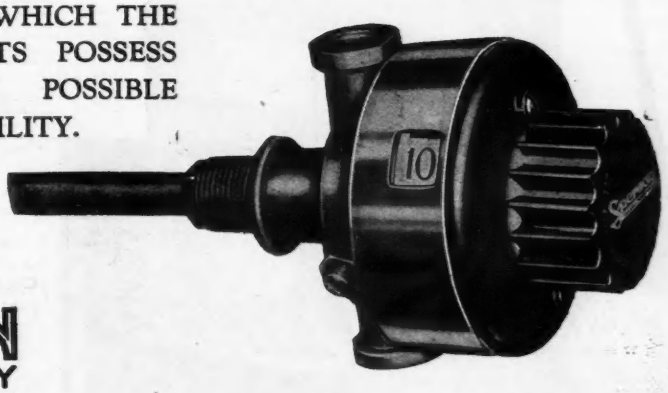


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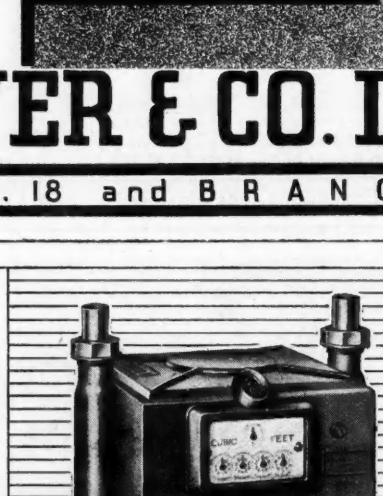

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p. 5

# GAS JOURNAL, FEB. 10, 1943

VOL. 241 95th YEAR No. 4160


## EDITORIAL NOTES

### NEW ROAD TAR SPECIFICATION

WE feel that indigenous tar has got a hold on the roads, and this is, we are sure, largely the result of the work over the years of the British Road Tar Association—continuous work on the scientific application of tar for the purpose, in brief, the technique of road making. It was fortunate in many ways that this body was in existence at the outbreak of war, and able through research and experience to help without any delay and with great practical effect in the solving of new problems arising out of the war. The services of the organization have been used to good purpose and are being increasingly sought—and will be sought when we start on post-war programmes of reconstruction. Many a 'plane owes its safe take-off to a tar base runway laid with certainty as to effectiveness whether in the tropics or the arctic, and constructed with speed.

In a previous note on the subject we foreshadowed a new specification for road tars drawn up by the British Road Tar Association in co-operation with the Department of Scientific and Industrial Research, mentioning that modern road tars are in fact generally far in advance of the British Standard Specifications which have been in force for several years. The new specification—War Emergency B.S. No. 76—was published yesterday. Prior to its issue, however, Government departments and highway authorities have been applying the recommendations contained in it. These recommendations, it may be added, have met with all-round approval. The specification replaces both the 1930 and the 1931 specifications for road tar. A new feature is the division of road tars into three types, A, B, C, based not on viscosity, but on road requirements. This division is related to their rates of setting on exposure, as distinct from the immediate set due to fall in temperature at the time of application, which is a function of viscosity. Type A has the most rapid setting properties; type C, which is a special material and at present available only in limited quantities, is very slow setting; while type B occupies an intermediate position.

What is important is that these types should not be confused with road tars Nos. 1, 2, and 3, which were covered by and familiarized themselves through the 1930 and 1931 specifications to which we have referred. In those specifications of rather more than a decade ago the differences were merely in viscosity. In point of fact all three tars were of the type corresponding to the new A type. Now to meet all requirements, the viscosity range covered by the old specifications has been expanded, and the new and wide range makes it impossible to record all viscosities at a single test temperature. To avoid any confusion that might arise from the use of various test temperatures the system of indicating viscosity as E.V.T. (equiviscous temperature) has been introduced. This is the temperature at which the tar has a definite flow as measured by the standard tar viscometer. Its use enables the viscosity of any road tar, whether very fluid or very viscous, to be expressed on a single scale. The value becomes progressively higher as the viscosity increases.

Changes have been made in the schedules of requirements. The permissible variations in the proportions of oils are appreciably less, and a maximum for the total distillate has been included. The proportions of phenols and naphthalene have been reduced, and an important new requirement has been included—the softening point of the distillation residue. This requirement should prove particularly useful in excluding unsuitable road tars. Then there is the "applicability clause." This now contains sufficient information to enable engineers to choose the tar they require for any purpose. The specification is designed to avoid confusion. Simple statement of the type of tar and the E.V.T. ought to prevent any error.

The foregoing are, we think, the main points in the new specification for tar for roads, application of which will heighten the prestige of tar in the eyes of transport and highway authorities and further ensure the satisfaction of the road user now and after the war.

### COAL ECONOMY AND OUTPUT

SINCE the outset of the Government fuel economy campaign economies in the consumption of coal have been substantial, and have not been due only to a mild winter. January was a mild month, but actually the weather up to the end of last December was as cold as in 1941. Increase in industrial consumption has been low—no doubt in large part due to the work of the Fuel Efficiency Committee of the Ministry of Fuel and Power, reference to which was made in a recent Address by the Director-General of Gas Supply, a report of which will be found on later pages of this issue of the "JOURNAL."

On the other hand the Ministry of Fuel and Power last Friday described the total output of saleable coal in the four weeks ended Jan. 23 as disappointing. The quantity raised averaged 3,813,400 tons a week. In the corresponding period a year ago it was 3,824,000 tons a week, but then severe weather and snow reduced output appreciably. There was no such interference with production this year, and the Ministry attributes the lower output, first, to a poor start after the Christmas holiday in England, and, secondly, to absences through sickness, which in some districts had been considerably above the normal.

Though more men are working in the mines, the weekly output since the output bonus was offered has exceeded that of a year before in only one four-weekly period. In January only three districts, with 16,400 miners—all of them small districts—have gained the output bonus.

For the first time the Ministry has been able to make a confident distinction between avoidable and unavoidable absenteeism, the latter including absences which enquiry has proved to be due to reasonable causes. In the last of the January weeks the total absenteeism was 12.32%, of which 7.43% was unavoidable and 4.89% avoidable. Among the coalface men the total of absenteeism was 14.78%, and of this 8.66% was unavoidable and 6.12% avoidable. Output for each man-shift worked averaged 1.058 tons in 1941. In the first quarter of 1942 it fell to 1.042 tons and in the second quarter to 1.029 tons. In July it fell still lower to 1.007 tons. There was an improvement in September and October to 1.055 tons, and in the following two months to 1.061 tons. During the last four weeks there was again a decline to 1.046 tons. In January of last year the output of the men at the coalface averaged 2.9 tons a shift, and this year 2.88 tons.

### THE RESEARCH ASSOCIATIONS

THERE are now twenty research associations spending about half a million a year on administration and research, one-third of which is provided by the Department of Scientific and Industrial Research funds and two-thirds by the industries themselves. Though based on a common type of foundation they are not uniform in set-up. This was pointed out in an interesting survey of the association scheme by Dr. P. Dunsheath in a recent Paper to the Royal Society of Arts. In

some cases the research work is brought together in a central laboratory, while in others it is spread over the laboratories of the constituent members and the universities. A typical example of the central laboratory is the extensive establishment at the Shirley Institute, Didsbury, the headquarters of the Cotton Industries Research Association. This Association spends close on £100,000 a year. The Iron and Steel Industry, through its Research Council, is the only association without central laboratory. No indication of the expenditure of this association on actual research can be obtained from the Council's report, as the figure of about £50,000 quoted in the annual budget could not possibly pay for the large amount of investigation carried out. Subsidized research at universities is a special feature of the activities of this body. It is obvious that the value and extent of the research carried out by an association cannot be measured by the annual expenditure, even in the case of efficient examples of research associations operating their own central laboratories.

Mention was made of the recently announced decision of the coal industry to spend £200,000 a year on research for the next five years, one-quarter being met by the Government and three-quarters by the industry. Yet one finds several important industries still outside the scheme, and analysis shows what a small fraction of the annual turnover is actually allocated to co-operative research.

## Personal

As we go to press we learn that Mr. C. A. MASTERMAN, who for the past year has been with the Gas Directorate, has been appointed Convener of the Post-War Planning Committee of the Gas Industry to succeed the late Mr. Stephen Lacey.

* * *

MR. T. BROWN, B.Com., General Manager of the South Suburban Gas Company, was on Jan. 28 elected to fill a vacancy on the Board of Directors of the Company. Mr. Brown entered the Gas Industry about 12 years ago, was appointed Secretary of the South Suburban Gas Company in 1932, and General Manager in 1937.

* * *

Acting on medical advice, Mr. W. LEES STENNING has retired from the Deputy Chairmanship of Associated Gas and Water Undertakings, Ltd. Mr. JOHN URQUHART becomes Deputy Chairman, and the vacancy on the Board has been filled by the appointment of Mr. THOMAS CARMICHAEL, Deputy Chairman of the Portsmouth and Gosport Gas Company.

* * *

Following the death of Mr. J. M. NICHOLSON, F.C.A., Deputy Chairman, Col. F. R. A. SHIEL, D.S.O., D.L., has been appointed Deputy Chairman, and Mr. A. G. I. ANDERSON has been appointed a Director of the Shotley Bridge and Consett District Gas Company.

* * *

Mr. WILLIAM R. OLIVER has been appointed Publicity Officer for the B.B.C. in Northern Ireland. In addition to his public relations activities, he will also act as war correspondent and topicality broadcaster. An executive officer for some years of the B.C.G.A., Mr. Oliver's work for the Gas Industry and in wider spheres of the "Display" world is well known. He was seconded in 1940 to the Ministry of Food to take up the position of Senior Publicity Officer, Public Relations Division, for special duties in connexion with the development of Food Education and the founding of Food Advice Centres. During the first Southampton "blitz," Mr. Oliver stayed in the city as an observer for the Ministry of Food.

* * *

Mr. E. S. ALLEN, for many years a Director and Representative of Metropolitan Gas Meters, Ltd., has joined the Staff of Messrs. Sawer and Purves as their Representative for the West of England.

## Obituary

Mr. LEON B. JONES, known to many in the Gas Industry, died suddenly in Cheltenham on Jan. 30. He left his home in San Francisco in 1937 to come to this country to erect an oil gas plant. After completing this he stayed and formed the Jones Gas Process Company, of which he was Managing Director and Engineer, to adapt the oil gas process to the manufacture of gas from tar and pitch, which he successfully accomplished. He was a technical man of great ability, and his untimely death at the early age of 52 will be deplored by the wide circle of friends to whom he had endeared himself since he made England his second home.

## Lead Alloy Pipes

The British Standards Institution has just issued a War Emergency Specification for Lead Alloy Pipes under the reference B.S. 1085. The foreword to this Specification states that it has been prepared at the joint request of the Ministry of Works and Planning and the Non-ferrous Metals Control, Ministry of Supply, with a view to ensuring the maximum economy in the use of lead. The quantity of lead now available for all purposes is extremely limited, and it has been necessary for the Ministry of Supply to place severe restrictions upon the use of lead pipe.

The composition of the metal differs from that required under B.S. 602. It has been found that the small percentage of alloying materials (copper and silver) have the effect of increasing the resistance of the pipes to creep due to steadily maintained internal pressure, as the alloy is capable of withstanding higher stresses than those which can safely be imposed upon commercial lead. This increase in resistance is such that the Committee are satisfied that the wall thicknesses of the pipes, and consequently the weights, can be reduced considerably, and that, from considerations of internal pressure and creep, pipes of reduced weights would be suitable under normal service conditions.

Solder joints can be made with the new alloy as easily as with ordinary lead pipe, and it is just as easy to work and handle.

Copies of this War Emergency Specification can be obtained from the Offices of the British Standards Institution, 28, Victoria Street, S.W. 1, at a cost of 1s. post free.

## Temperature Measurement

We have reached a stage in the war when the supply of energy for industrial processes has become one of the limiting factors in our war potential. It is, therefore, particularly opportune that the British Standards Institution should publish a comprehensive code for temperature measurement, for the measurement of temperature is essential in the control of energy transformation. The B.S.I. code is the first of its kind published in any country, and has involved several years of investigation by a strong committee of scientists, instrument makers, and engineers. The code covers the whole range of industrial thermometry starting with the International Temperature Scale, based mainly on the work of the National Physical Laboratory, and going through mercury thermometers, thermocouples, resistance thermometers, and radiation pyrometers of all kinds. A valuable section deals with the sources of error, and there are also several sections covering special problems of thermometry such as the measurement of the temperature of gases and liquids and the surfaces and interiors of solids.

In the preamble, the code is stated to be of a provisional character issued for war purposes, and it will be subject to revision as soon as the situation permits. The code has been in use in a number of laboratories and works for some time past on an experimental basis and its value has thus been thoroughly established.

Copies of this British Standard may be obtained from the British Standards Institution, 28, Victoria Street, S.W. 1, price 12s. 6d. net (post free).

**The Metropolitan Gas Company** of Melbourne is paying a dividend of 5s. per share on Feb. 15.

**The Machinery,** Plant, and Appliances (Control) (No. 3) Order, 1942, regulates that no manufacturer of controlled goods shall supply any controlled goods upon which he has carried out any process of manufacture otherwise than to a person authorized to acquire those goods by a licence granted by the Board of Trade and in accordance with any conditions attaching to that licence. "Controlled goods" includes gas-fired furnaces having a consumption exceeding 250 cu.ft. per hour.

**The Success** of potato week, organized by the Ministry of Food at Cambridge, can be justly shared by the Cambridge University and Town Gas Light Company, which fully co-operated in the campaign. The first cookery demonstration was held at the gas showrooms, where a series framed to encourage new ideas in the use of potatoes continued throughout the week. At the five demonstrations there were about 200 attendances, and 600 recipes and other literature were distributed. In view of the great interest created during the official week, the Gas Company decided to hold three further demonstrations.

**"How Gas is Produced from Coal"** was the subject of a broadcast talk on the B.B.C. Home Service programme on Feb. 2 by Mr. Felix Felton, who described his impressions on visiting a gas-works where horizontal retorts are the gas-making plant. "It seems to me," he concluded, "that the whole of gas-making is a large-scale form of economy. . . . It made me realize what a vital thing coal is."

**The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.**

# FUEL ECONOMY AND THE CHEMIST

## Address by Dr. E. W. SMITH, C.B.E., Director-General of Gas Supply

AT a Joint Meeting of the Chemical Society, the Institute of Chemistry, the Society of Chemical Industry, and the Institute of Fuel held at Bristol University on Jan. 21, Dr. E. W. Smith, C.B.E., Director-General of Gas Supply, gave an Address on "Fuel Economy and the Chemist." The Chair was taken by Mr. A. Sanders, of the National Smelting Company.

The **Chairman,** after expressing his satisfaction at the large attendance, said the subject of Dr. Smith's Address was a topical one in view of the great drive being made to ensure fuel economy in industry generally and, indeed, in every direction.

Dr. **Smith** said he did not think he could do better than try to discuss with chemists and industrialists just where chemists could be of assistance in the fuel economy campaign. There was a necessity for saving coal—and he would confine his attention to coal and all that coal was used for—just as there was a necessity for saving rubber, petrol, and other materials, but for different reasons. In the one case it was necessary to save shipping; in the other it was desired to save coal not merely because there was not enough coal raised, but because the equipment with which coal was used in any form had been so stretched that there was not the equipment to use coal to the extent they should like. Consequently it was essential that wherever coal was used—for gas, electricity, or any other purpose—there should be maximum conservation, largely due to the enormous demands that had been made on plant, equipment, coal, and labour. The Ministry of Fuel had set up a substantial Committee known as the Fuel Efficiency Committee under the Chairmanship of Dr. Grumell. That Committee, he was pleased to say, consisted almost 100% of chemists. It was a technical Committee which acted in an advisory capacity on all the technical problems of fuel economy throughout the country. There were also in the various regions into which the country had been divided practical committees responsible to the Fuel and Power Controller, and they kept in the closest possible touch with the Fuel Efficiency Committee, which had done some exceedingly good work. In addition, there were fuel economy committees connected with the various industries. The steel industry had its own national committee and also its regional committees. The Gas Industry had its own Regional Advisory Boards, each one of which was autonomous in its region and got on with the job of saving coal. All these committees kept in the closest touch—or should do—with the Regional Fuel Controller, who acted as a sort of co-ordinating influence among all these committees.

The necessity for saving coal had been proved and demonstrated more particularly in areas where there had been large expansions in the demand for coal and gas and electricity, and while over a year ago it was agreed that a great deal might be done in improving equipment for the use of coal and gas, it was also realized that during wartime much more could be done by tackling both industrial and domestic problems by the psychological attack and the administrative attack; and in all this the chemist could play an important part. It was easy for the engineer to say he would not trust a chemist and give him a free hand in the works, as he would probably upset the workmen and bring in highfalutin equipment, taking $CO_2$ recorders here and interfering with production there, and so on. But that attitude was indefensible. If there was one thing that had impressed him in his long experience of the Gas Industry particularly and of industry generally, it was that chemists were rarely properly used.

What was a chemist? The chemist was not just an analyst. If a chemist was to be of any real use, in a broad way it was not the fact that he was a chemist that was going to make him helpful in the fuel economy campaign. It was that he had gone through a training of orderly thinking which had made him able to determine what was relevant and what was not; what was important and what was not important. Apart from the fact that he had knowledge of the chemical reactions of combustion and the like, a thoroughly trained chemist was a man with a scientific mind, and in the analysis of any situation or any proposition should be of the maximum assistance to management. He wondered just how far managements in the Bristol area were using chemists in that way. How many were there who brought young boys from school and first allowed them to type reports, and, in the case of a gas-works, were later shown how to carry out determinations of calorific value and then went through the mechanical job of making gas analyses, and ultimately became laboratory assistants or assistant chemists, after a few years? These men were not chemists. They were useful men and served a valuable purpose and might become quite good analysts, but they were not, in the sense he was trying to indicate, trained thinkers and the type of man whom management should take a chance with after a year or two. These men would not know a great deal about a particular business when they were taken in, but they were trained thinkers.

When the Government wanted to appoint a committee the first thing they did was to appoint someone—probably a man of Law—who was able to evaluate evidence and able to ask the right questions. He might not know the facts, but he was able to get the facts; and a lawyer was a most valuable man to have, even on a technical committee. The same applied to the chemist and the engineer when they had had a thorough scientific training—trained to think and to evaluate evidence when they had the facts, and to come to proper conclusions. If chemists of that type were employed, then managements could, with safety, allow them to start overhauling the machine of fuel economy.

Of course, a great deal of experience was necessary behind this trained thinking. It required experience of human nature. Of course, under present conditions it was not possible to let loose in the works men who were going to overhaul everything; production was the thing that mattered at the moment, and usually in charge of the equipment there were workmen of long experience who, from the point of view of processing, must not be interfered with radically. He had found, in going through very large works in different parts of the country, that however rough a workman might be and however experienced he was, he was always amenable to reason if he were approached in the right way.

All this sounded very simple, but it was the basis of handling industry. He went over a works not long ago which had been threatened that if they required more gas for a big development, the gas would not be available—and nothing but gas could be used in that particular case. Fortunately there was an open-minded and broad-minded management, backed by a broad-minded staff, and they called in experts, who were asked to look at the various processes and try to help. Some quite ordinary technically and scientifically trained chemists with long experience went into those works. It was a glass works where special bulbs were being heated at a certain temperature at a definite rate in a continuous process. It was found that a large number of small flames were normally used, but with the addition of a few baffles in this continuous equipment, and the alteration of the angle of certain burners, the gas consumption of 12,500 cu.ft. per hour was reduced to 3,400 cu.ft. per hour, and with fewer spoils. The old method of firing had been employed for years.

A works in the North which he had visited was using 1½ million cu.ft. of gas a day and they were likely to want to double the consumption within the year. It was a big quantity, and it meant that the fluctuations in that works affected the whole of the remainder of the city. The furnaces in that works which were working inefficiently accounted for all the savings that could be made domestically in a very large area. Just over a year ago they started in these works what were known as "gas chasers." In one of the shops there were 20 furnaces, each consuming 16,000 to 20,000 cu.ft. of gas per hour. Mr. Ronca went over the works with him and they saw some of these furnaces with the gas on full but not a single article in them, and there were temperatures of 850° to 900°C. The doors were frequently left wide open, and there was evidence of bad combustion conditions generally in that there was smoke everywhere. Flames were coming from the leaky doors, there was bad insulation, badly adjusted dampers. It was suggested that 40% saving could easily be made without much trouble. When he visited the same works a year later—a few weeks ago—it was found that the firm had doubled its output during the year and were burning less gas.

These, said Dr. Smith, were just a few instances of where the chemist came in. In passing, he mentioned that when his own companies expanded their laboratories some years ago he had appointed the best chemist he could obtain as general manager of a large laboratory. He had told that chemist that he was the service department of the companies, that he would be receiving materials for analysis from all quarters, and that it was his job to make the best possible use of these analyses. At the same time he had stated emphatically that this chemist was not to carry out a single analysis for any department unless he had been supplied with all relevant information concerning the problem so that he could tender sound advice on the problem in question. He was determined that the laboratory staff should not be slot machines to carry out analyses without intelligence behind them. That policy had been helpful, for what had been the result? Not only the senior chemist, but each of the men in the laboratory had a full knowledge of all the implications of the work they were doing, and each one of them was able to give advice which could not be obtained from the general manager or the chief operator or the like. It was essential that chemists, if they were to be used to the maximum advantage, should be part of a team within the undertaking. There should be nothing in the processes that was secret from them. If there was, then management was not using the chemist properly, and was not getting the maximum possible out of him in making use of the experience which he could pass on for the benefit of the undertaking.

Continuing, Dr. Smith said he was interested in carbonizing problems in which it was necessary to get down to very narrow limits of

fuel consumption, and he was of opinion that chemists on gas-works ought to be able to maintain the $CO_2$ in the waste gases within 0.5% of the pre-determined figure they had decided to work to. There should be no difficulty about that. Most of those present at the meeting were connected with the Gas Industry, and he was satisfied that if there was a real demand made in the Industry over the next 12 months to adjust what might readily be adjusted, it should be possible to save one million tons of coal per annum and still maintain the same output.

The Gas Industry was technically relatively well run, but there were 1,200 to 1,500 undertakings. It was true to say that more than 1,000 of them had not chemists. They would like chemists, but the undertakings were too small. Therefore, if there were to be any radical changes in the Gas Industry—and there would be—there would have to be a great deal more co-operative work between the undertakings. A case had come to his notice within the past week—there were a large number of them throughout the country—in which an undertaking had had to close down because it could not pay its coal bill, which amounted to £300, and there were only about 160 consumers! How could it be expected that a works of that size—he agreed it was an extreme case—to have a manager who was expected to be not only a good engineer, a good distribution man, a good secretary, but also a good chemist—in fact, the perfect general manager—and pay him properly and get proper results from the undertaking? It simply could not be done, and the position in the future would have to be groups of undertakings with common chemical control, common accountancy, which was just as important, and common costing, because the basis of the Industry must be to know the facts. Unless the facts were known it would be impossible to get the best out of the undertakings, and it was impossible to know the facts if there were no facilities for determining them.

This was what he wanted to encourage the chemist to do—to know the facts. There were also the facts of the administrative side, in which the chemist must take an interest. The chemist must not be satisfied to be in one little room marked "Private," with the General Manager in another room marked "Strictly Private"! There should be a door between these rooms, and when any matter was raised in which the chemist was interested, he should know about it.

It was necessary for the chemist to draw on his experience. If ever the chemist wanted to take charge or wanted to become more than a scientific adviser, he must be prepared to take the responsibility of decisions in broad matters of policy and recommendations of a technical nature. Chemists as a whole must be adventurers and must have courage, and that was only possible when they had a thoroughly sound experience and training behind them.

Chemists in the fuel industry, and particularly the Gas Industry, could pull their weight very well, and he had been delighted to hear that week that the Midlands Regional Gas Board, realizing the deficiencies of chemical control and proper engineering control, had decided within their Region to set up an organization in the form of a travelling laboratory. This would be on a motor-driven car with two chemists and there would be sleeping accommodation in the car, and there would also be a complete set of the essentials for a gas undertaking's tests. This equipment and staff would be hired out, on a rota, to gas undertakings that had not chemists, and it would enable the smaller undertakings to do the essential chemical work. This Region was one of the best in the country, but the Gas Advisory Board had decided on this step because they had satisfied themselves that it was going to pay handsomely to tune up the Industry to the extent which this laboratory would enable them to do.

What were the fuel problems in the Gas Industry? In the first place the coal came into the works with its 300 therms per ton, and the Ministry of Fuel and Power was preparing returns for every gas undertaking in the country showing the saleable therms after deducting the necessary heat that had had to be expended in order to carry the process through. These saleable therms had been deducted from the 100% and the expended heat had been expressed in a figure. The average for the whole country showed that taking into account the gas that was made for sale, plus the coke, and the tar and benzole, the expended therms, on the average throughout the country, amounted to 26. In other words, 74% of the therms in the coal were sold. That was a datum line to enable a rough comparison to be made. If one looked at the various gas undertakings of the country, the medium size ones were not doing too badly. The figure of expended therms varied between 18 and 36, and the average was 26.

Where could losses occur? Take the case of horizontal retorts. It should not be possible, with a normal coal in normal conditions, to produce a gas with a lower calorific value, after benzole washing, than about 520 B.Th.U. per cu.ft. Such a gas would probably have about 10% of inerts—nitrogen, oxygen, and $CO_2$—and the figure should not be higher. But supposing it was higher, why was it higher? The same applied to continuous verticals. The inerts should not be higher than 10%. It was possible to mention 20 gas undertakings within 100 miles of Bristol—small ones, it was true—in which horizontal retorts were used and where the calorific value of the gas was lower than 420 B.Th.U! Looking through the various groups it would be found that the higher the calorific value, the higher the therms per ton, in nine cases out of ten. The higher percentage of inerts meant that gas was being deliberately burned before leaving the retorts. Then there was the fuel used to provide producer gas, and ashes were taken out of the producers with too high a content of coke. If the chemist were allowed to make a study of these things he could be very helpful in the proper running of producers, and the same thing applied to steam raising, the control of excess air on the boilers, the $CO_2$ content, and so on.

He would mention carburetted water gas plants. He visited a gas-works recently where they were anxious to satisfy themselves that they were doing the best possible, having in mind that the oil had to be brought from overseas. They brought in an expert, who found that the spray which should have atomized the oil passing into the generator was partially interfered with and a solid jet of oil was going into the generator. There was no proper atomization. There was also a good deal of oil going through another spray and across to the side of the generator. By an adjustment of these sprays, which were of a large type, there might be a saving of something like 25% of oil. This demonstrated the advantage of ordered thinking plus experience and a fresh mind as applied to carbonization processes.

Another direction in which there could be large savings, apart from the savings of a temporary nature that were being made to-day, was in the elimination of sulphur. If sulphur was taken out of town gas, there was no reason whatever why the background heating of their houses should not be done by the use of gas with flueless heaters. Of course, this would bring about a number of changes. In the past, Factory Inspectors had indicated a certain limit of $CO_2$ content of the atmosphere of rooms where people were working. That limit was originally based on the $CO_2$ that came from human breathing. Tests had shown, however, that the $CO_2$ content of rooms could increase many times without deleterious effect, and that rooms would become a great deal too warm long before the $CO_2$ content rose to a figure which would be harmful for health. Therefore, he hoped there would be a real attack on the question of eliminating sulphur from town gas, because the effect of that at once was going to halve the amount of gas that was necessary for any particular room to attain any particular comfort conditions. To-day, the gas fire might be taken to have an efficiency of 40 or 50%. A luminous flame properly fitted in a flueless heater might readily have an efficiency of 90%, so that the amount of heat necessary for the background heating, in which the walls would have no condensation and there would be no deleterious effects, would be at once such as to make gas twice as efficient as it was to-day. There was here opportunity for development.

Mr. **R. Robertson** (General Manager, Bristol Gas Company), in the course of the discussion following the Address, suggested that the training of the chemist was on too academic lines, and led him to consider that the collection of data and setting them out in nice tables was an end in itself. As to the possibilities of saving fuel in the Gas Industry, he said that those connected with the Industry knew how much could be done in that direction. Perhaps in the past they had suffered from getting their fuel too easily and too cheaply, and therefore had not bothered very much to economize. He could only endorse all that Dr. Smith had said of the possibilities of the losses in gas-works' practice, but there was another side to this matter. With the best chemical staff in the world and the best plant in the world, it was impossible to get the best results with the type of labour which was now being supplied by the Ministry of Labour. The Labour Exchanges were supplying men without any regard to their capacity for the work they were to do; it was simply a case of counting heads, and the result was that the gas-works were being denuded of all their skilled craftsmen, who were being replaced by the last word in the labour market that could not be absorbed anywhere else. Until that aspect was grasped by those responsible for the administration of the fuel industry, no progress in the direction indicated by Dr. Smith would be made. Last, but not least, there was the question of the quality of the coal now being received, and with which it was quite impossible to carry on the process with any degree of regularity. One cargo of coal would contain 10% of ash and the next 25%. The trouble was that whereas the gas and electrical industries were carefully supervised under statutory control, the coal industry could do just as it pleased and charge what it pleased and supply what it pleased. Mr. Robertson said he felt strongly on these matters because all the good work Dr. Smith was trying to do so admirably would be negatived unless something were done.

Dr. **Smith** said he was fully aware of the troubles of the Gas Industry, and the Industry generally, despite bad coal, bad labour, and so on, had done marvellously. If he himself were to be discouraged by the troubles that had arisen and were arising from day to day in the Gas Industry or the coal industry and elsewhere he could not carry on, and it was for the chemist and the engineer to work to the limit of what was possible within the conditions as he found them. He knew the Gas Industry had been badly hit with regard to labour, but the Industry was to-day in the highest priority for labour and practically everything else. This should have been the case 12 months ago. As to coal, there were all kinds of good reasons why bad coals were being sent out. In most cases it really could not be helped, but taking the average of the country as a whole he doubted whether the ash content of coal had increased by more than 1 or 2%. The reason for Mr. Robertson's difficulties was that his plant had been designed to work at its maximum capacity with a particular class of coal and a particular grade of coal. Normally, the Gas Industry carried 25% of spare plant capacity, but now that the demands for gas were coming up to 100%, any variation in the quality of coal suitable for the plants upset the working.

# FUEL ECONOMY IN GAS WORKS

**No. 3**

**We are indebted to the Severn Valley Gas Corporation, Ltd., and Gas Consolidation, Ltd., for permission to reprint a series of notes specially compiled for them by G. M. Gill.**

## REDUCING FUEL LOSSES IN HORIZONTAL RETORT SETTINGS

### Regulation of Primary and Secondary Air Slides

ONE has to start somewhere in bringing about improvements in the working of retort settings. Possibly an examination of the waste gases leaving the settings would make as good a start as anywhere else.

As is well known, in dealing with the producer gas-fired setting—and it is proposed to ignore the direct-fired type as these are now comparatively rare—the producer gas passes through the nostril holes and there meets the hot secondary air at the bottom of the combustion chamber. The secondary air here admitted should be sufficient to burn the whole of the producer gas—that is, from carbon monoxide to carbon dioxide. There is also more or less hydrogen, which has been formed in the producer. This, after burning in the combustion chamber, gives off its heat to the retort walls and then leaves as steam up the chimney.

Thus:

| | Producer gas. | | Secondary air. | | Waste gas. |
|---|---|---|---|---|---|
| | $2CO$ | + | $O_2$ | = | $2CO_2$ |
| and | $2H_2$ | + | $O_2$ | = | $2H_2O$ |

The completeness or otherwise of the combustion of the producer gas in the setting is judged from the chemical analysis of the waste gases at the inlet to the recuperator.

If the regulation of the air is correct, the waste gases will contain 18% to 20% carbon dioxide. If there is insufficient secondary air being used, a test will show that some amount of carbon monoxide is present. If there is too much air, it will show that no CO is present, but that some amount of oxygen is passing through with the waste gases to the chimney. In the first case more secondary air should be used, while in the second case less should be used, though it is considered in practice advisable to have 1% or rather more excess of oxygen in the waste gases.

It must, however, be pointed out that there are a good many pitfalls in this matter of regulation of settings. When a producer has just been clinkered it is probably making more producer gas than it was just before it was clinkered, and therefore it is advisable, when regulating air slides, to carry out tests of waste gases midway between clinkering times, and so endeavour to strike a happy medium.

It is, however, necessary to sound a note of warning. It is a skilled job to regulate the slides and dampers in a retort house. It is a chemist's job and a practical one at that, and if it is to be done well he must carefully watch the result of every alteration, and be guided also by his tests. Further, it is important to make one alteration at a time and watch the result before making the next change.

Practical common sense is, however, highly desirable if a success is to be made of the air slide and damper arrangements in a retort house. Thus, it is obvious that if producer gas is being burnt in the recuperators, or is going up the chimney, it is being wasted and ought to have been burnt by the secondary air round the retorts. It is equally obvious that if too much secondary air is being admitted into the combustion chamber, then all that air has to be heated up at the expense of the retorts, and thus heat is being wasted.

The man who is responsible for such regulation must not be guilty of either fault, but it is quite certain that he cannot do this work properly unless he understands the full meaning of combustion, both theoretically and practically. Sometimes a chemist and a retort house foreman together will do this work very well, but the latter unguided by the chemist is very unlikely to do the job properly. The chemist may do it quite well, but not unless he has also a practical mind.

It is suggested, therefore, that the manager should satisfy himself that a large measure of trouble is being taken to regulate dampers and slides intelligently, and that full use is made of chemical analysis in doing this work.

### Recuperators

Obviously it is wasteful to allow the waste gases from retort settings to pass away at too high a temperature, unless, of course, the gases are supplied to a waste-heat boiler. The waste gases, after leaving the retorts, have to heat the secondary air on its way to the combustion chamber. To do this properly the flues must be kept free from dust, while air must not be allowed to leak into the recuperator flues through sight holes; further, the recuperator walls must be free from cracks and bad joints.

As an object lesson, take the temperature of the secondary air entering the flue at the bottom of the combustion arch, and passing into the combustion chamber. It may have risen, say, 700°C. during its passage from the bottom flue. At the same time, take the temperature of the waste gases entering and leaving the recuperator. Then thoroughly clay up all the sight holes of the secondary air and waste gas flues, leaving these for four to six hours before again taking the same temperatures. It is quite likely that the secondary air entering the combustion chamber will be considerably hotter, but it is probable also that the waste gases leaving the setting through the damper will also be hotter because there has been less infiltration of air into the waste-gas flues. However, that does not matter if the secondary air has been raised in temperature, so bringing about a lower consumption of coke for fuel.

The higher temperature of the waste gases leaving the setting will fulfil one useful purpose and that is to increase the chimney draught as the result of which it may be possible to reduce setting dampers.

Always keep out unwanted air, whether it is into secondary air flues, which upsets proper regulation of these, or into waste gas flues, as it cools the gases and affects the heating of the secondary air, and also lessens the chimney draught.

Should the waste gases be passing into a waste heat boiler it becomes imperative to prevent air infiltration into waste gas flues, as such infiltration greatly reduces the temperature of the waste gases and proportionately reduces the quantity of steam produced. Unwanted air is a great enemy of waste heat boiler efficiency. Even a small amount of air infiltration has quite a serious effect, rendering the boiler a good deal less efficient.

It is therefore most important to watch temperatures of waste gases leaving recuperators and entering the waste heat boiler, and also the percentage of $CO_2$ in the waste gases at the same points. Both will show what is taking place and will be a clear guide to the working and to any faults needing correction. Particularly is it necessary to prevent infiltration of air from settings which are shut down, as this can completely destroy the good effect to be obtained by using a waste heat boiler.

### Loss of Gas through Cracks, &c.

In the aggregate there is a great deal of loss from this cause. Indications of such loss can be seen when black smoke comes from a chimney when a retort with a bad hole has been charged, and when gas, lighted or otherwise, is seen coming from mouthpieces.

The proper thing to do is to examine retorts before these are charged, and have all holes properly patched before the retorts are charged. Good men will do this if the management is of the right kind, but if the manager does not bother, the men will not. As a result, much of the gas from the whole charge of coal will be lost, possibly for charge after charge, until the hole is finally repaired. In the case of machines which discharge coke and charge coal simultaneously, all good managers will insist upon the coke being pushed out once a day, by itself, so that the retort can be examined. It is obvious that all retorts with holes or cracks should be repaired at once.

So far as mouthpieces and lids are concerned, this is a fault which must be tackled regularly and thoroughly. There is no better way of doing this than to put the retort house every day under 1 in. of pressure and chalk every gas leak, and then set about repairing each leak. Mouthpiece joints need tackling from the inside by carefully filling in the space through which the gas leaks, or, what is still worse, the space where air gains admission. Probably gas escapes through the bad joint for some time after the retort has been charged, and then air leaks in and burns its quota of gas, the flame passing up the ascension pipe to convert some of the tar into pitch and carbon, with the result that before long there is a stopped pipe with all the loss and trouble which results therefrom.

It is quite likely that if pressure had not been put on the retort house the leak would not be discovered and the same pipe would be blocked again and again.

Until the leak can be tackled, it is important to stop it with clay on the outside. This will prevent air from entering until such time as a proper job can be made of it.

Mouthpiece lid joints are a fruitful source of trouble in loss of gas, admission of air, production of bad gas, stopped pipes, disgruntled workmen, and generally bad results. It is easier to tackle the problem and stop it. Again, the best way is to put the retort house under 1 in. of pressure and mark all the bad lids and then tackle the job.

Obviously one essential thing to do is to clean the lids and the faces of both mouthpieces and lids, and then arrange that these are done regularly. Adjustments of some of the lids will be necessary if these have not been kept clean in the past.

Bad lid joints will have the same baneful effect as bad mouthpiece flange joints. Both constitute a chronic disease in a retort house and should be tackled thoroughly and at once. As in the case of mouthpiece flange joints, gas leaks from lids should be clayed until the joints are made good in a proper way. Stopped pipes can be expected so long as unwanted air is drawn into the retorts.

## Admission of Air

Another reason for excluding air from the retorts may now be discussed. If air is drawn into the retorts through mouthpiece and lid joints, and during the time when the retorts are opened for charging, discharging, scurfing, or repairs, this obviously has the effect of lowering the quality of the gas being made. As a consequence the next step which has to be taken is to check the pull on the retort house, with the result that all the retorts making good gas are checked, and so more good gas is lost through cracks in the retorts and through joints that are not tight. Thus, by allowing air to get in when this ought not to happen, there is, as a result, eventually a substantial loss of good gas.

There is no question that one essential thing to do is to run your retort house so that the oxygen percentage in the gas is always low—say, not more than 0.3%.

As stated above, the most effective way to reduce the oxygen content is to put the retorts under 1 in. pressure daily and stop all the leaks.

## Radiation Losses

Horizontal retort settings are not very readily adaptable to proper lagging by heat-insulation material. The front walls are made up so largely of iron mouthpieces that it does not leave much scope for insulation bricks on that part of the setting. At the same time, the Author has always specified the introduction of insulation bricks into the front walls of settings, and is fairly confident that these have been advantageous from all standpoints.

The top of the bench should certainly be covered with 4½ in. or 6 in. of insulation bricks with one protecting top course of blue bricks. This will have a material effect on heat losses, and on the comfort of men working on the top of the settings, and also will be beneficial in reducing the overheating of any tar in the hydraulic mains.

There is one substantial loss of heat to which attention should always be paid, and that is the pointing up and stopping of all air leaks into settings, and benchwork. Lots of cracks develop in course of time, and it is most important that these should be stopped. It is a good plan periodically to cover all heated firebrick work with a stiff wash of fireclay cement, well brushed in or sprayed to fill all cracks, bad joints, and porous surfaces, a good many of which are not readily visible to the naked eye.

This practice will also have the effect of brightening up the retort house, which is always a wise thing to do, as it has a good effect on the men.

Cracks in retort house brickwork can have a serious effect on the working of the settings. Particularly is this noticeable when the cracks are in main flues leading to the chimney and in the chimney itself. It occasionally happens that such cracks spoil the chimney draught and so seriously upset the heats. An examination should be made of this part of the plant.

Another loss of heat, resulting also in damage to retort settings, is caused by leaks of liquor, water, and tar from hydraulic mains, tar and liquor mains, overhead tanks, and bad roofs. This sort of thing is a sad reflection on the management, but nevertheless it is no rare occurrence to find such leaks, or that these have occurred at some time in the past. The remedy is obvious.

## Retort House Governors

To obtain good results in any retort house, it is important if not essential to use a really good retort house governor and one that will regulate to $\frac{1}{10}$ in. Exactitude of pressure conditions in retorts, hydraulic mains, and foul mains is highly important. Without precise control in this portion of the plant real efficiency is difficult to obtain. No one, so far as the Author knows, has ascertained the relationship between retort pressure and calorific value of gas produced. That there is a relationship there can be no question. The fact remains that the carbonizer without an efficient retort house governor is badly handicapped.

Oscillation in retorts is a bad enemy of good results. This is one reason that vertical retorts, horizontals fitted with anti-dips, Congdon standpipes, and unsealed dip pipes give better results in therms per ton than horizontals with seals, other things, of course, being equal.

It cannot be right to introduce a seal through which gas must find its way in getting out of a retort, none of which, one must admit, will withstand any measurable pressure without leaking. Theoretically, if the seal on a retort is, say, 1 in. and a vacuum of 1 in. is maintained in the foul main, there should be level gauge in the retort. Actually there is nothing of the kind, as the gas passing through the seal sets up considerable turbulence, with the result that the actual conditions in the retort are likely to vary from, say, ½ in. pressure to ½ in. vacuum. The effect of this is detrimental to good results. The oscillation thus formed in the retort has the effect of alternately pumping gas from the retort into the flues and sucking flue gases from the flues into the retort—a bad exchange.

Accordingly, the abolishing of seals on retorts in favour of efficient governors and the abandonment of methods causing oscillation is very advisable, it is suggested, if really good results are to be obtained.

## Stopped Ascension Pipes

Stopped pipes are a fruitful cause of bad results. This trouble is a disease, sometimes chronic. With ordinary care in the carrying out of a regular routine there should be few if any stopped pipes. Certainly there would be none in a properly managed retort house. The cause of this trouble can be attributed to one or more of the following:

1. Not augering the ascension pipes each time the retorts are discharged.
2. Use of undersized augers.
3. Air entering through mouthpiece or lid joints and burning gas in the ascension pipe.
4. Pitched hydraulic mains due to tar standing in hydraulics and getting distilled by the heat into pitch.
5. Stoppages in bridge and dip pipes and in the upper part of the ascension pipes. This trouble is due to past neglect in not clearing the ascension pipes.

The remedies for all these causes of trouble are obvious enough. Augers should be kept up to size—that is, ½ in. less in diameter than the pipe itself. These must be used every time the retort door is opened. The trouble caused by allowing air to get into the retorts and ascension pipes has been discussed at length. The remedy is to put the retort house under 1 in. pressure, mark all gas leaks, repair the causes of leaks, stop with clay those which cannot be repaired immediately, and continue to do this until the defect has been remedied.

If trouble is experienced with stopped pipes, it is a good plan to open the retorts with the troublesome pipes halfway through the charge and push through the auger at this time. The deposit in the pipe will have been softened to some extent by the hot moist gas, and as a result good progress can be made in this way.

Pitched hydraulics create a somewhat difficult problem. It is advisable in cases of this kind to shut down a setting suffering from this trouble for four hours or so, remove the cover plates of the hydraulic mains, and then cut out the soft and hard pitch and any other deposits, after which the setting can be put back to work. Stoppages in the upper part of ascension pipes, bridge pipes, and dip pipes can be cleaned with augers and rods or be burnt out, except, of course, the dip pipes. When a retort is scurfed it is advisable to make a rule of also burning out the ascension and bridge pipe.

Thick scurf on retorts is wasteful of fuel and it lowers the productive capacity of the retort. Frequently it throws a strain on the stoking machines, which are designed for a certain size and shape of retort. It follows, therefore, that the machine cannot also be suitable for a retort whose shape and size have been materially altered by scurf.

The proper method to employ is to decide upon a regular routine for scurfing, only counting upon a certain proportion of the retorts for gasmaking. Like so much else in retort-house working, any manager who has not laid down a definite routine for scurfing has not done his job. Such things cannot be left to foremen and workmen to do as they like.

The Author recently had an experience which he is not likely to forget. The works in question had two settings of retorts, both of which had to be at work during the winter months. The manager (so-called) did not scurf any retorts for months on end, with the result that the scurf became so thick that it caused overheating of the retort walls, which disintegrated and broke away, causing the collapse of the retorts. In this particular case both settings were ruined, more or less at the same time, and created a crisis for the particular works.

## Work of the Chemist

There is much in the operation of horizontal retort plants which calls for the work of chemists, without whose assistance much must be carried out by rule-of thumb methods. These are not good enough.

The chemist, to do his job properly, must have the following instruments to aid him to help the manager to run his retort house efficiently:

Orsat gas analysis apparatus.

Draught gauge registering to $\frac{1}{100}$ in. ($\frac{25}{100}$ in. pressure to $\frac{75}{100}$ in. vacuum).

Disappearing filament pyrometer.

Complete gas analysis apparatus.

Recording vacuum gauge at inlet to retort house governor, and preferably also a nitrometer for estimating the nitrogen in the crude gas.

The chemist should be the eyes and ears of the manager, and give him facts and figures which will show what needs to be done and what is working correctly. The assistant manager, works superintendent, and foremen concerned with the working of the retort house should be kept in close touch with the chemist's work and should learn how to interpret the results—that is to say, if they are not already fully informed on this subject.

# ADMINISTRATION AND ACCOUNTING PRACTICE

## IN SMALL AND MEDIUM-SIZED GAS UNDERTAKINGS*

By P. KNOWLES, United Kingdom Gas Corporation, Ltd.

THE Paper is presented, in the main, to junior technical assistants who are looking forward to the time when, as a result of their technical and practical training, they will secure appointments as engineers and managers, with which position there is often incorporated the office of Secretary.

There are few instances where a technical assistant during his training period considers it necessary to give attention to matters other than those actually connected with gas manufacture and distribution, and he is therefore inclined to the view that the successful running of an undertaking begins and ends with its operational activities. A few moments' consideration will, I think, reveal that the administration side is almost as, if not equally, important. It is no use having efficient manufacture if the benefits arising therefrom are subsequently lost by inefficient administration.

It is appreciated that it is a somewhat difficult matter for a technical assistant to acquire the necessary practical knowledge of the administration and accounting side of the business, as in most large undertakings the two sides are often entirely separate and distinct. In the case of municipalities these matters are nearly always controlled by the treasurer and town clerk—one step further removed from the engineer, manager, and/or secretary of a company. Although the engineer and manager of a municipally owned undertaking has no responsibility for the accounts, it is considered that he should be familiar with all matters appertaining to his undertaking. In the case of companies, however, where the official has to assume total responsibility, it is a matter of vital necessity.

Before joining the United Kingdom Gas Corporation, Ltd., my connexion with the Industry had been restricted to large undertakings, and I had failed to appreciate the difficulties which presented themselves to the engineer and manager of the small and even medium-sized companies.

The work of co-ordinating the Accounts of many small and medium-sized undertakings, and of observing administration costs and results, has brought home to me the realization of how necessary it is for all technical officers who are to undertake the duties of management to have training in accountancy and administration.

### Financial Control

A. *Control of Expenditure including Purchase of Plant, Machinery, Materials, and Appliances.*

There are times when considerable sums of money, proportionate to the size of the undertaking, must be spent on (i) essential renewals, (ii) alterations, giving improvements, or on (iii) additions to provide for current or future extension of business, and providing careful consideration and good judgment are given to the matter under review, such expenditure should be profitable. Don't forget, however, that expenditure has to be financed by L.S.D. upon which Interest has to be paid immediately, although the expenditure in the case of (ii) and (iii) may not show any beneficial results for some considerable time. Also bear in mind that (i) becomes an immediate revenue charge and may considerably affect the trading results in a particular year. Look wisely ahead in the matter of mains, and never lay a main which, in a relatively short period, will have to be replaced by one of larger capacity. It may, of course, be impossible to see far enough into the future to prevent this, as new housing estates have been, and probably will again, be erected in the most unlikely places. There have, however, been too many instances where a short-sighted policy has been adopted, which has subsequently involved considerable additional expense by the necessary replacement of a main which has only been laid for a comparatively short period. This expenditure could easily have been avoided. I think, fortunately, we have passed the time when many companies are seriously inconvenienced by having to finance appliances for simple and free hire, and the experience of my Corporation in the two years prior to the outbreak of war proved that the requirements of all classes of consumer can be met by hire purchase, with extended periods and terms covering a large part of the life of the appliance, provided such hire purchase is put forward by efficient salesmen.

Expenditure under (ii) and (iii), which does not become productive in a reasonable time, results in over-capitalization, which, in turn, probably affects the ability to maintain dividend yields. In the pre-war years it was considered that an economic capital structure was from £500-£700 capital expenditure per million cu.ft. of gas sold.

B. *Allocation of Expenditure between Capital and Revenue.*

(1) *Expenditure on Machinery and Plant* which has not previously existed is undoubtedly capital, excepting that it is considered all expenditure on services and fittings, even for new and additional consumers, should be charged to revenue; the materials used generally occupy positions from which it is impossible to recover them in the event of a consumer ceasing to take a supply.

(2) *Alterations and/or Renewals to existing Machinery and Plant* or the replacement of existing machinery and plant by different kinds of machinery and plant to perform similar functions. The point to be decided here is what it would have cost to replace the existing machinery and/or plant with exactly a similar type, at the time of the alteration and/or renewal. In many cases the query will be raised that it is impossible to purchase the counterpart of the old plant, or, alternatively, that it would be foolish to do so even if it could be purchased, by reason of the improvements which have taken place in the meantime. These two queries are, however, entirely irrelevant to the point in question, and if it is impossible to obtain the renewal cost—although it is suggested the original contractors will always be prepared to give this figure "without prejudice"—a notional amount must be arrived at. Having arrived at this figure it becomes the revenue charge and is deducted from the actual cost of the new machinery or plant, the balance being debited to capital. In the unlikely event of the notional amount being in excess of the actual cost, the whole of the actual cost should be a revenue charge. It can, however, perhaps be argued that when such actual cost exceeds the original cost, but is below the notional cost, as there is some improvement a portion of the actual cost should be charged to capital; but in these days one is inclined to take the income-tax point of view, especially if it is favourable to the company. These observations are only operative if the company has remained on a renewals basis for income-tax purposes; if the wear and tear provisions of the last agreement made between the National Gas Council and the Inland Revenue have been adopted, then all renewals expenditure should be debited to capital and tax at the appropriate rate on the future wear and tear allowances credited to capital as depreciation.

(3) *Repairs Expenditure.*—Do not be influenced by the amount of expenditure. It may well be that expenditure of, say, £10 is renewals, while £2,000 is repairs. The generally accepted principle is that, unless it is a renewal of the whole of a machine, it is a repairs charge, but the proportion of the cost in relation to the whole may in some cases have a decided bearing on this point. There would, I think, be no hesitation in regarding as repairs expenditure of, say, £1 on renewing parts of a meter originally costing £3, but there may be some hesitation in regarding as repairs £2,000, spent on resheeting a gasholder costing originally £6,000, excluding tank, although both items of expenditure bear the same ratio. It is suggested both items are repairs.

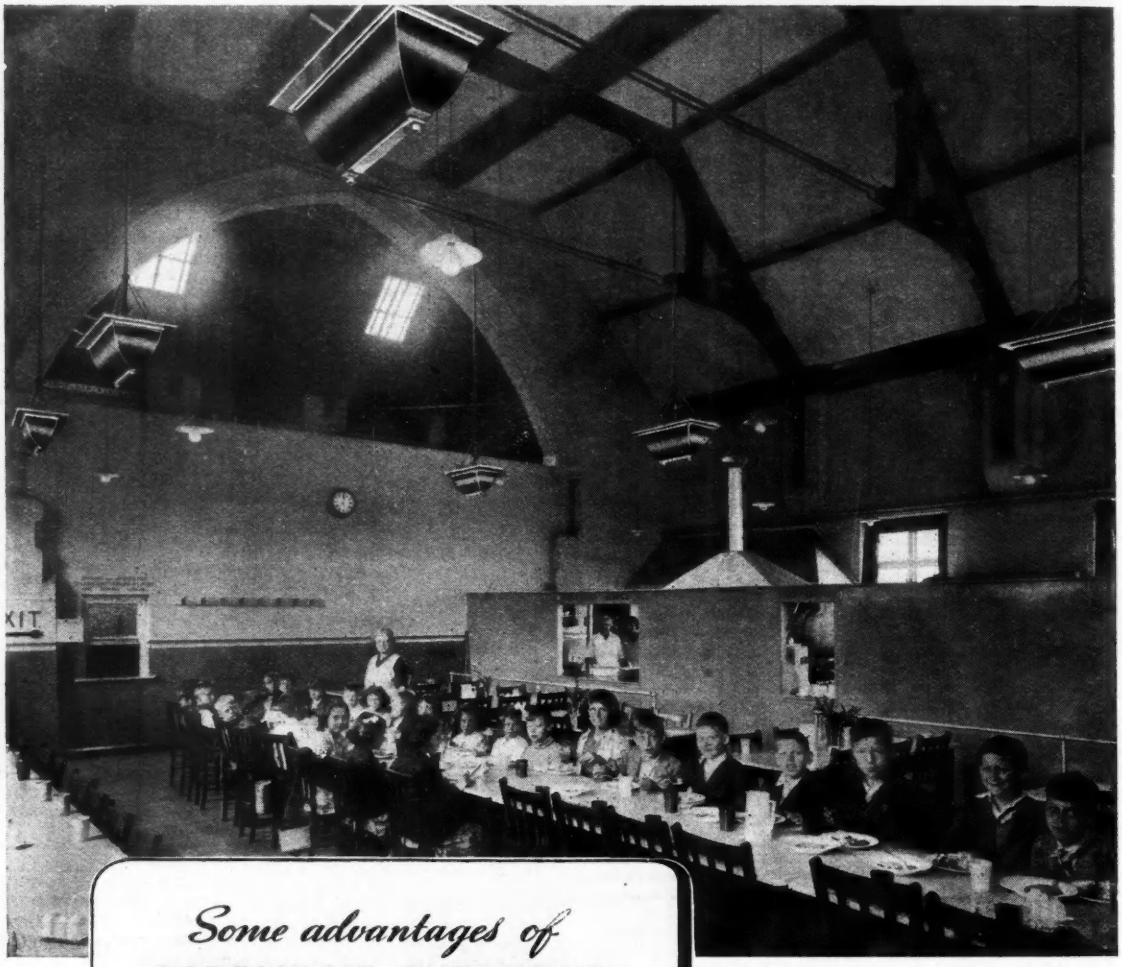
(4) *Spreading of Abnormal Repairs and Renewals.*—I would like to refer to a point which I find in actual practice occasions some consideration, and that is the amount to be charged against a particular accounting period for expenditure incurred in that period in respect of abnormal repairs and renewals which are really applicable to other years' trading, and are too large a burden to be borne in one period. I know that a number of companies have power to create renewals funds which can be used for the purpose of providing for these items, and these comments, therefore, principally affect those companies which do not possess these powers. I incline to the view that the best method is to ascertain the average cost of repairs and renewals over a period of years, and use this as a quota or ration to be debited against the revenue account of each accounting period. The reflective entry would be a credit to a repairs and maintenance suspense account, which account would, in turn, be debited with the actual expenditure incurred. The provision of an equal annual charge would prevent an engineer and manager who was so disposed from deferring necessary repairs with a view to producing a satisfactory trading result, when the full burden of accumulated repairs would fall on his successors. A separate quota or ration should be fixed for repairs works and plant, repairs mains and service pipes, repairs meters, repairs of internal fittings and appliances, and cost of new services and fittings. The quota may have to be reduced or increased from time to time in the light of experience as to whether the repairs and maintenance suspense accounts were accumulating unwieldy debit or credit balances.

C. *Banking and Raising Capital Moneys.*

Banks are, generally speaking, prepared to grant unsecured overdraft facilities up to reasonable sums, for the purpose of financing the normal trading requirements of an undertaking, but capital expenditure should be covered by the share and/or loan borrowing powers and such expenditure should be funded by the issue of share and/or loan capital before the expenditure is incurred. It is considered that it will be found an advantage to keep a separate banking account called "Capital Account" into which capital receipts should be deposited, and from which capital expenditure payments should be made.

Providing a company is financially sound, there should be no difficulty in getting the investing public to take up capital issues, at reasonable rates. Such issues in excess of £10,000 in any twelve months are at present subject to the consent of the Capital Issues Committee, and it is essential to obtain such consent before the money is spent.

* From a Paper to the Manchester and District Junior Gas Association.

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Companies are at present somewhat handicapped by not being allowed to disclose to the public in any prospectus in connexion with an issue particulars of the company's trading results, but this may generally be substituted by a statement showing the rate of dividends paid for, say, the past 15–20 years. It will, of course, be necessary for such dividend statement to show a satisfactory position.

D. *Accounting and Book-keeping.*

It is difficult to suggest under a few headings the principal items to which an engineer and manager's attention should be drawn, as it involves a detailed explanation of all the numerous books of account, also records of original entry, and the various systems which can be adopted in compiling such records. A detailed explanation would require a lengthy separate report, and it is considered that at the moment such explanation is outside the purport of this Paper.

Briefly, however, an engineer and manager should satisfy himself that the book-keeping items contain an accurate record of a full twelve months' income and expenditure, so that the ensuing twelve months' trading will not be called upon to make good any deficiencies of the previous twelve months' trading.

I would impress on engineers and managers the urgency of keeping a control of—

(*a*) Meter reading dates to ensure that 365 days' (366 in Leap Year) gas consumption is reflected in a twelve month's revenue account.

(*b*) Examination of slot meter reading cards to see that a meter is not consistently recording "short" consumption.

(*c*) Sales invoices to ensure that all materials and residuals sold and excluded from stocktaking at the accounting date are taken into account in the revenue account.

(*d*) Examination of purchase invoices to verify that provision has been made in the revenue account for all goods delivered and/or taken into stock at the accounting date.

(*e*) Constant examination of outstanding items owing for gas sales, H.P. appliances, residual and fittings sales, to avoid bad debts.

(*f*) *Apportionment of Standing Charges and Income.*—Standing charges, such as rates, insurance, income tax, &c., should be correctly apportioned so as to represent the charge properly attributable to the particular accounting period.

Income applicable to future years should also be apportioned—*e.g.*, that portion of the selling price of H.P. appliances deemed to represent profit. Interest and maintenance costs should be spread over the length of time it will take before the last instalment becomes due for payment. Don't forget that during that time there is a revenue charge for maintenance costs, also, for interest on money borrowed to finance the purchase of the appliances and fixing materials, plus the wages costs. If the whole of the balance between the selling price and the cost price of the appliance and fixing material, plus wages, has been credited to revenue in the period of the sale, the future years' maintenance and interest cost will become a charge on profits from gas sales and residuals.

(*g*) *Stock Quantities and Prices.*—It is recommended that a physical stock be taken at least four times each year, two of which should be on the accounting dates, it being presumed that half-yearly accounts will be prepared. Physical stock of all other materials and stores, wherever these may be lying, should be taken at the accounting dates.

It may seem to a number of my audience that my comments regarding physical stocktaking are superfluous, but, incredulous as it may appear, I know from personal experience that revenue accounts have been prepared and published time and time again without a physical stock having been taken, and I have no doubt this bad principle still exists.

I would advise an engineer and manager of a company not large or wealthy enough to employ mechanized accounting to give very serious consideration to the use of carbons to obviate recording the same figures twice over. This is the basis of some mechanized accounting systems, and it is a comparatively simple matter to obtain the same results, but not at the same speed, by the use of hand-written carbon entries. They will result in labour saving and the avoidance of clerical errors, which easily arise in transferring figures from one source to another.

There is also one simple and elementary matter to which I would like to refer—the usefulness, and indeed the necessity, of a full and careful analysis of income, and, more particularly, expenditure items, with the view of ensuring all items fall under the correct heading in the revenue account. Don't be afraid of providing more than enough analysis columns in all accounting books, particularly in the expenditure journal and wages book, and having provided them, don't be afraid of using them. One invoice for quite a small amount in respect of materials purchased may have to be analysed under numerous headings, such as capital mains, works repairs, mains repairs, meter repairs, services and fittings repairs, materials for H.P. appliances, stock, &c.; so also might one man's wages have to be analyzed under, say, six or more headings.

In my opinion, no engineer and manager can be satisfied unless he can conscientiously say that he knows the exact amount of expenditure falling under each revenue account heading in relation to the cost per therm of gas sold, and I am sure he will certainly want to know the gross and net cost of gas into holder.

The correct figures of repairs and maintenance are assuming more importance under wartime conditions, and doubtless it is well known that maximum price companies who have reached the maximum price of gas charges are compelled by the Ministry of Fuel and Power to have regard to expenditure on repairs and renewals figures before any relief is given under S.R.&O. No. 2629 of 1942.

I would like to mention two further points before leaving the general principles of accounting and book-keeping. The first is the adoption of codes for analysis purposes, instead of writing lengthy descriptions of allocations. Coding ensures that all assistants understand and use the same code number for similar kinds of goods and materials on all occasions, whereas if assistants are left to their own devices, the same kinds of goods and materials are at different times likely allocated under different headings.

The second is the benefit to be derived from having all purchase and sales invoices numbered numerically; this should also be extended to any document forming the basis of any book-keeping entry.

E. *Costing.*

Costing is extremely estimateable and is what every engineer and manager should aspire to, but how far it is a practicable achievement in small or medium-sized undertakings is problematical. Briefly, it means that the exact cost of jobs is ascertainable by the allocation to its respective job of materials used and wages expended plus a charge for overheads, which includes all items falling under administration, management, and interest on capital.

If thoroughly carried out it would enable an engineer and manager to have monthly revenue and profit and loss accounts prepared, providing the consumers' meters for sales below the flat rate were read monthly.

F. *Ability to Read and Understand Thoroughly the Various Items appearing in the Statement of Accounts.*

There is no doubt whatever that this is equally as essential for an engineer and manager as the manufacture of gas and residuals, as the latter is only an uncompleted part of the whole, and it is not until the revenue account and the balance sheet are available that an engineer and manager knows whether or not his work on the manufacturing side has been successful. He may have worked exceedingly hard, and, in his own opinion, profitably, but figures have an unfortunate habit of showing a totally different picture from the one expected. The figure of profit or loss, however, may not be correct, although the books have been balanced and checked by the auditors, as there are many factors which, while not disturbing a balance of the books, may materially affect the trading results shown by the accounts.

I advise particular attention to the carbonizing figures, also to the percentage of gas sent out which is "unaccounted for" by the receipts from gas sales.

Low carbonizing figures and poor yields of residuals denote trouble on the manufacturing plant and/or labour trouble, while a high percentage of "unaccounted for," provided this is not affected by a change in meter reading dates, generally means leakages in holders, mains, meters, or service pipes. It is very surprising the loss which can arise through faulty meters, and it is even not unknown for meters to be in use by consumers although, through faulty records, the company have no knowledge that such a meter exists. One of the smaller companies of my Corporation has, by an extensive meter renewals campaign during the past 18 months, reduced the "unaccounted for" figure by 11%.

Work out the revenue and profit and loss account items on a basis of "pence per therm of gas sold" to three decimal places. Prepare comparative statements of previous years' income and expenditure figures. It will be found the "pence per therm" figures will be exceedingly useful in making those comparisons, as they reflect a much truer position than it is possible to get by a comparison of sterling items, as in the latter case it is necessary to have regard to the effect on the figures arising from increased or decreased business. Go thoroughly into items showing increases or decreases, and satisfy yourself that the increases were unavoidable. Submit a copy of the comparative statement to your Directors, together with full explanations of the differences.

G. *Preparation of Estimates of Income and Expenditure for ensuing Trading Periods.*

These estimates are even more important than the above statement of accounts, because whereas the accounts show the result of a past period and cannot be corrected, the estimates disclose the position, as far as is known, of a future period, and give an opportunity of taking steps to correct any adverse position which they may disclose. It will be appreciated that undertakings in pre-war periods had to stand three months' increases incharges before such increases could be recouped by increased gas charges to ordinary consumers, and this is further aggravated under war conditions by having to apply to the Ministry of Fuel and Power for the necessary licence to increase gas charges.

It is considered these estimates should be prepared on a half-yearly basis, and that every effort should be made to ascertain the correct estimated figures of all the various items of income and expenditure. I find a strange reluctance to bring the proportionate charge for income tax into account, but this is, of course, equally as important as the coal figures.

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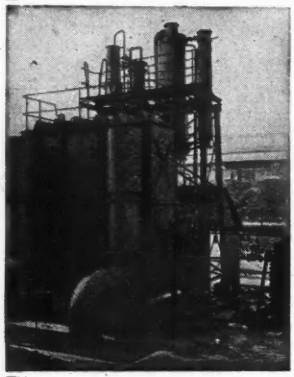
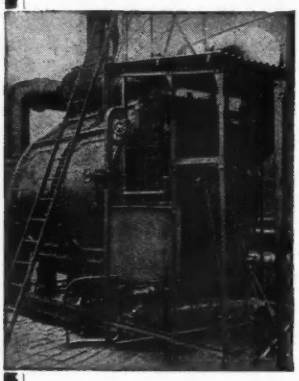


*"Permac Joints" in a Gas Works.*



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# Gas Products Prices

### The London Market Feb. 8.

The chief item of interest in connexion with the Coal Tar Products market is the issue of a new Government Order, the Coal Tar Products Prices Order, 1942 (S. R. & O., 1942, No. 2509), which came into force on Jan. 1.

All Coal Tar Products are in good demand, and Pitch in the London area remains about 45s.

### The Provinces Feb. 8.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 90's, 1s. 10d., pure, 2s. 5d. (controlled by the Control of Toluene No. 2 Order, July 3, 1941, which fixes the maximum price at which this material may be sold). Naphtha and Xylol controlled by the Coal Tar, Naphtha and Xylol Order, 1942, dated Dec. 7, 1942, and operative from Dec. 21. Carbolic acid, 60's, controlled by the Coal Tar Acids Prices (Inland) Order, 1942, operative from May 1. Naphthalene, controlled by the Naphthalene prices (Inland) Order, 1942, dated April 15, 1942, and operative from May 1, 1942, £19 to £19 10s.—bags free. Anthracene, controlled by the Anthracene Prices (Inland) Order, 1942, operative from May 1. Filtered heavy oil (min. gr. 1,080), 7½d. to 8d. Creosote oil has been generally controlled as to direction and price for some time past. Current value—fuel grades 5d. to 5½d.; timber preservation and other purposes 4¾d. to 6d.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

### Tar Products in Scotland Feb. 6.

Substantial throughput is maintained. Refined tar controlled. Value is 4½d. per gallon *ex* Works, naked. Creosote oil: Specification oil, 6½d. to 7d.; low gravity, 7¼d. to 7½d.; neutral oil, 6d. to 6½d.; hydrogenation oil, 5.875d. per gallon, all *ex* Works in bulk. Refined cresylic acid is changing hands in fair quantities at 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha, 6½d. to 7d. per gallon. Solvent naphtha: Basic prices delivered in bulk, 90/160 grade 2s. 8d., and 90/190 Heavy naphtha, Unrectified, 1s. 10½d.; Rectified, 2s. 3d. per gallon. Pyridine: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

# Gas Stocks and Shares

Easier conditions spread over most sections of the Stock Exchange last week. Markets, generally, were dull and prices showed no particular tendency. Quieter conditions also prevailed in the Gas section, where the volume of business was on a small scale. In most cases where stock changed hands, however, the general trend of prices was in an upward direction. The effect of this can be seen in the lists below. British ordinary was the best feature, with a rise of 7 to 97½. A parcel of this Company's 5½% cumulative preference is on offer at 112 to yield £4 18s. or £4 15s. after allowing for redemption; the stock is redeemable in 1967 at 105. Among ordinaries available is a parcel of 9,600 Gas Consolidation £1 "B" shares at 17s. 3d. yielding £5 16s. on the last rate of dividend, and also 5,000 United Kingdom Gas Corporation £1 shares at 19s. 9d. giving a return of £5 1s.

The following price changes were recorded during the week:

**OFFICIAL LIST**

| | | |
|---|---|---|
| British Ord. | 95—100 | +7 |
| Commercial 5 p.c. Deb. | 103—108 | +3 |
| Gas Light 4 p.c. Pref. | 82—87 | +2 |
| Ditto 3¾ p.c. Red. Pref. | 80—85 | +1 |
| Ditto 3¾ p.c. Red. Deb. | 93—96 | +1 |
| Mid-Southern Utility "C" | 83—88 | +1 |
| Oriental | 97—102 | +1 |
| Portsmouth Cons. | 105—110 | +5 |
| Primitiva Holdings Ord. | 11/6—13/6 | +1/- |
| South Metropolitan 6 p.c. Pref. | 91—96 | +1 |
| United Kingdom 4½ p.c. 2nd Pref. | 15/—17/- | +-/6d. |
| Watford & St. Albans Ord. | 107—112 | +7 |

**SUPPLEMENTARY LIST**

| | | |
|---|---|---|
| North Middlesex 5 p.c. Pref. | 90—95 | —5 |

**PROVINCIAL EXCHANGES**

| | | |
|---|---|---|
| Blyth Ord. | 103—104 | +1 |
| Hartlepool Ord. | 75—76 | +2 |
| Liverpool Ord. | 104½—105½ | +2 |
| Newcastle Units | 21/9—22/3 | +1/- |

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